Transiting Exoplanet Survey Satellite (TESS)

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Operators:
NASA / MIT

Mission goals & objectives

- **Detect and characterise exoplanets**
    - **Measure planet mass, size, orbit, density**
- Survey ~200,000 of the brightest stars near the Sun to search for transiting exoplanets.
- Focus on G-, K-, and M-type stars with apparent magnitudes brighter than magnitude 12.
- 1,000 closest red dwarfs
- To discover 20,000 exoplanets (vs. 3,800 known)
    - 500-1000 Earth-sized and super-Earth-sized
- Complement by ground-based follow-up observations on planet candidates

Mission approach

- 2 year mission
- Sky survey divided in 26 different sectors: 24 x 96 degrees across (85% of the sky)
  - Length sector: 27 days (2 orbits)
  - Stare and step. Two-minute cadence on the brightest stars
- TESS stars 30 to 100 times brighter than those the Kepler mission and K2
- TESS sky area 400 times larger than Kepler.
- 20,000 additional objects during the mission through its Guest Investigator program.
- Full-frame images exptime 30min transmitted as well for transient science

TRANSFER ORBIT

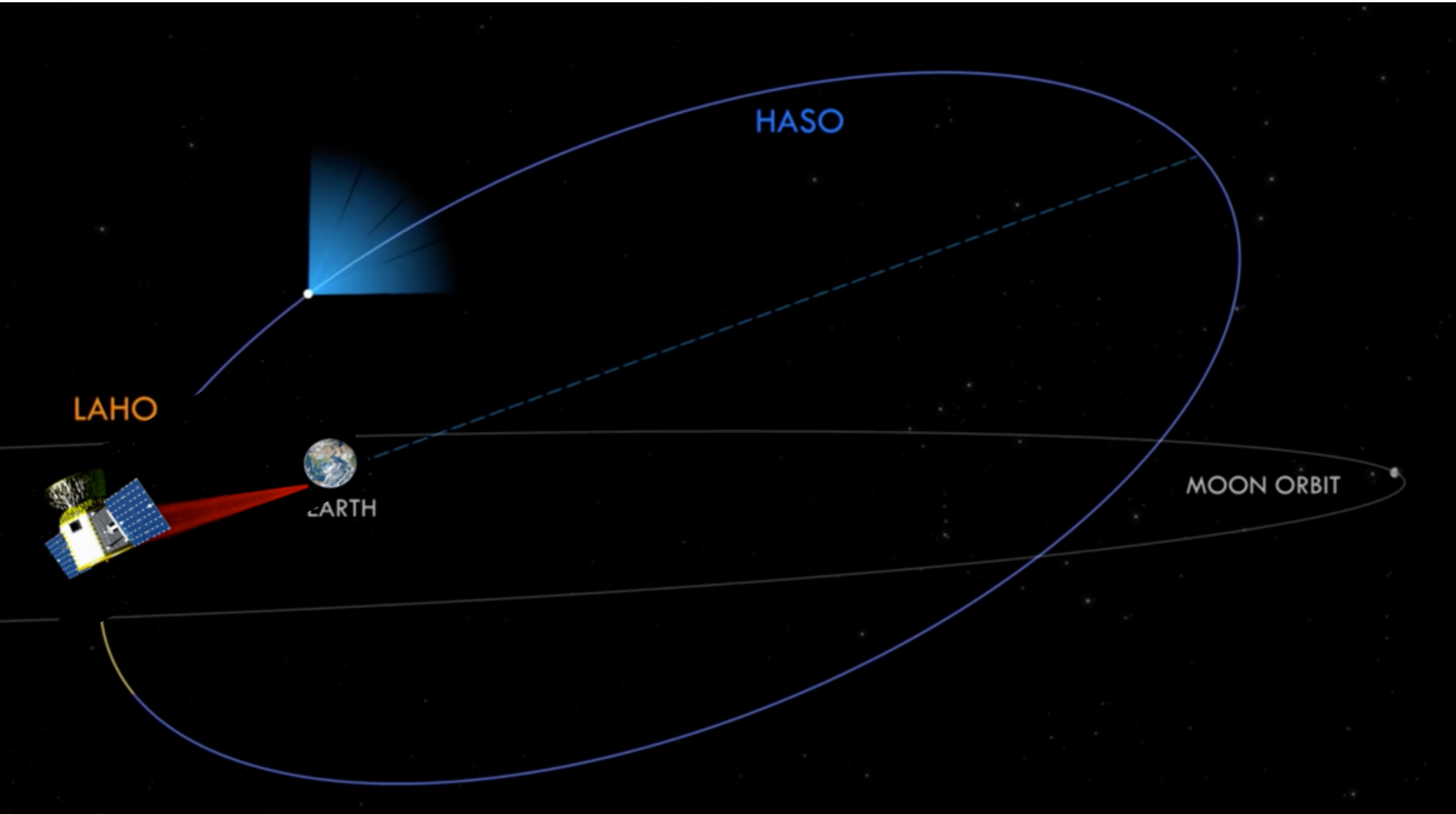
PLEA: 75 R_E

MISSION PERIGEE: 17 R_E

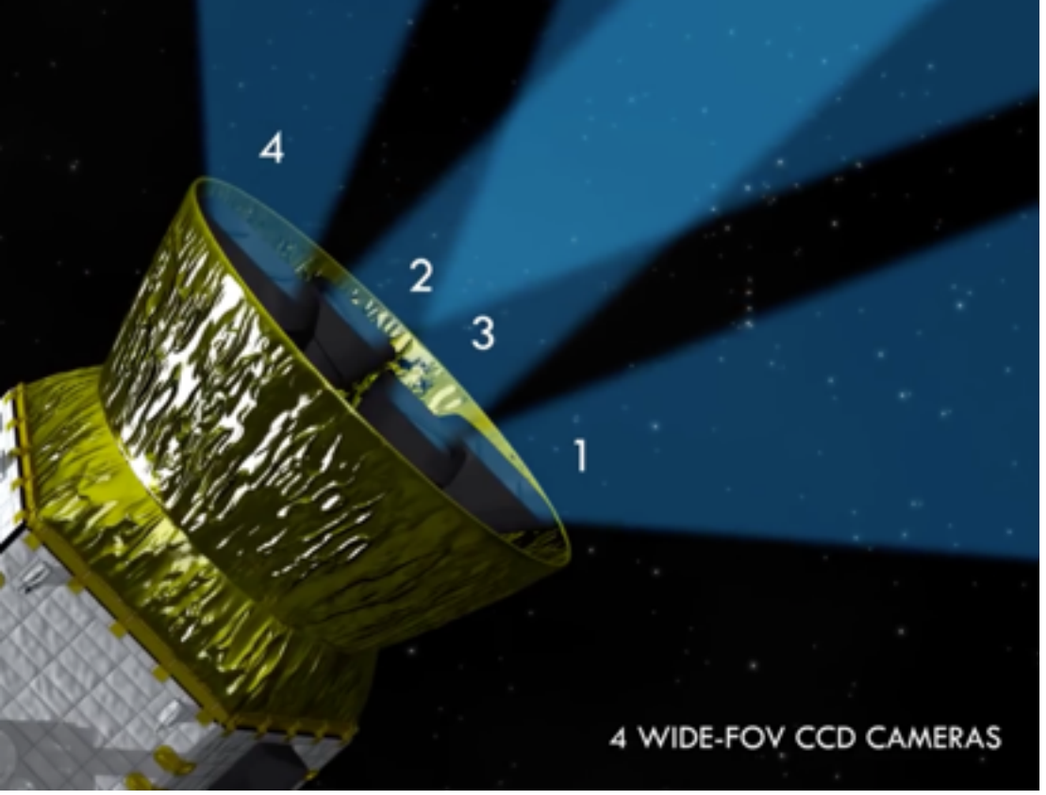
TESS

FINAL MISSION ORBIT

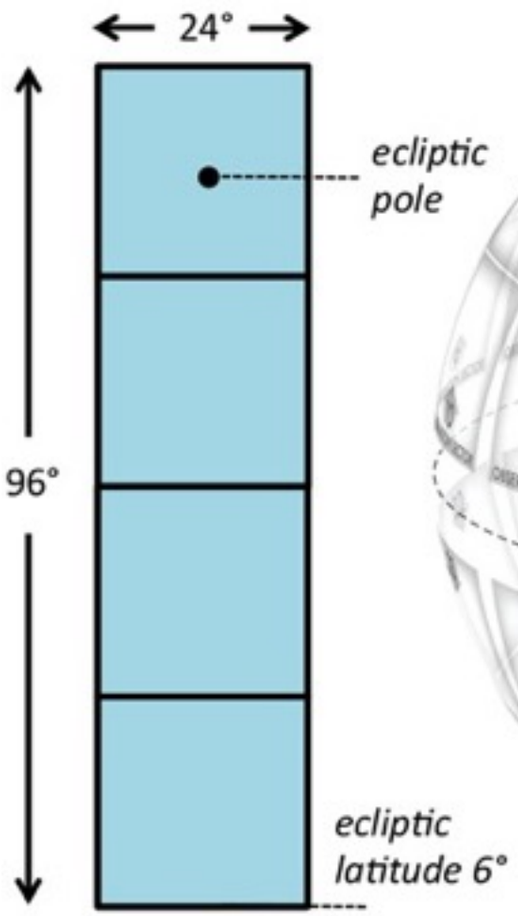
- 3h downlink every 13 days at perigee
- mission orbit period 13.7 days

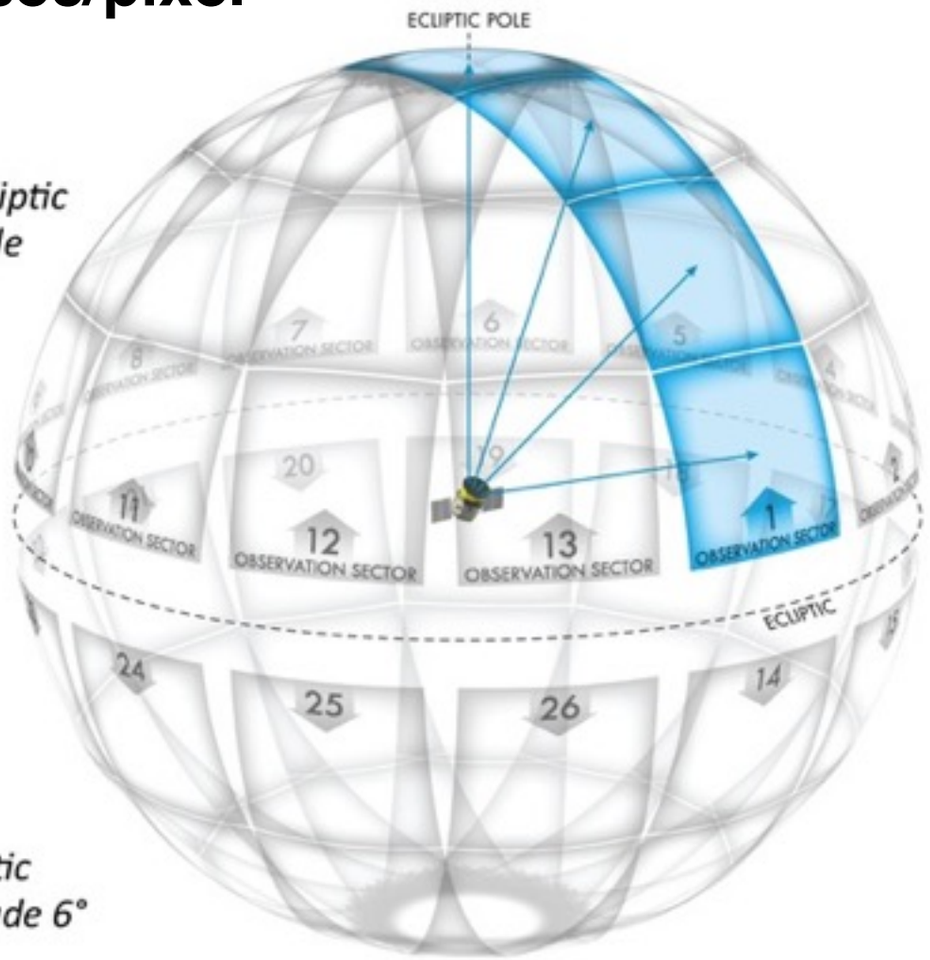


Scanning law



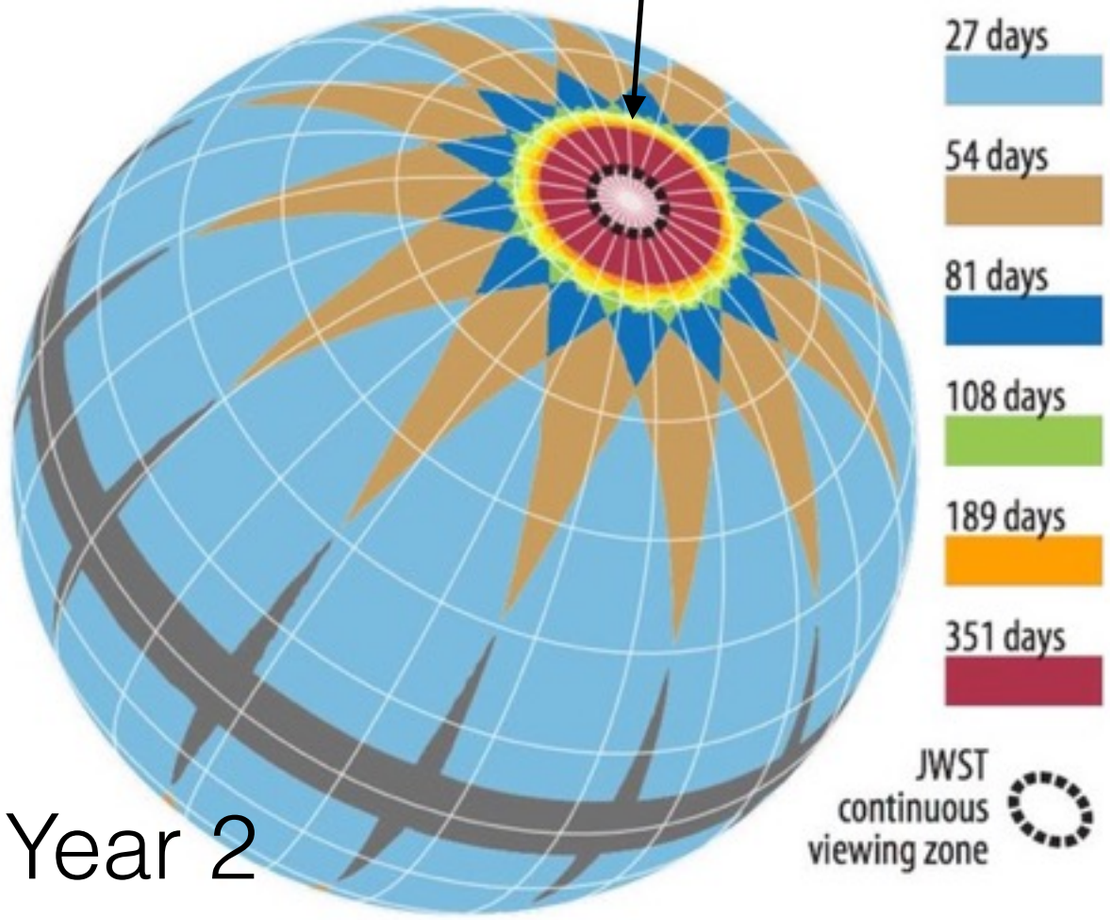
6000-10000 Å
21 arcsec/pixel





JWST
continuous
viewing zone

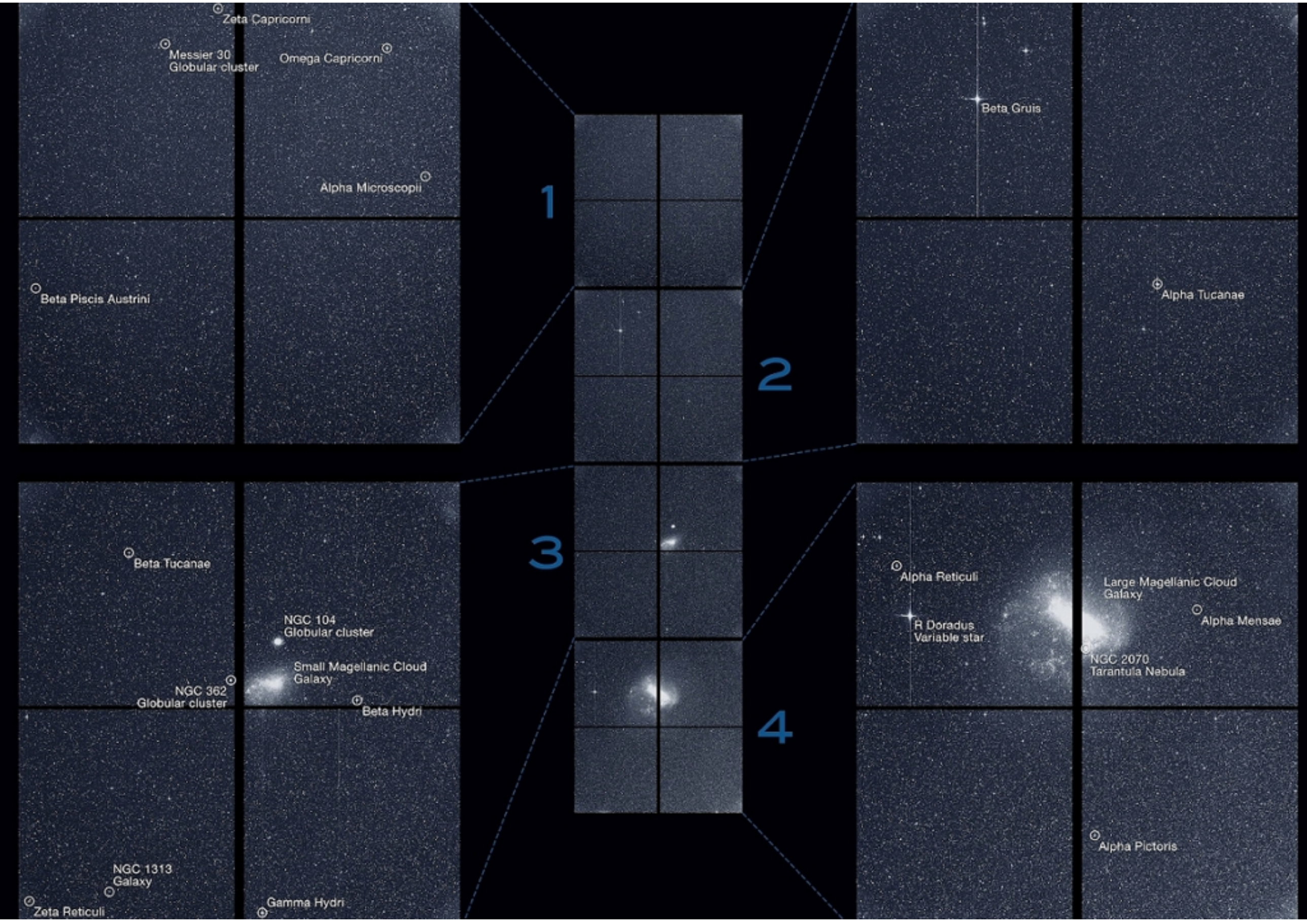
Year 1



Year 2

Mission status

- TESS launched on April 18, 2018
    - SpaceX Falcon 9 rocket.
- Started science operations on July 25, 2018
- The first light image taken on August 7, 2018
- Released publicly on September 17, 2018


Zeta Capricorni
Messier 30
Globular cluster
Omega Capricorni
Alpha Microscopii
Beta Gruis
Beta Piscis Austrini
Alpha Tucanae
1
2
Beta Tucanae
NGC 104
Globular cluster
Small Magellanic Cloud
Galaxy
NGC 362
Globular cluster
Beta Hydri
Alpha Reticuli
R Doradus
Variable star
Large Magellanic Cloud
Galaxy
Alpha Mensae
NGC 2070
Tarantula Nebula
3
4
NGC 1313
Galaxy
Zeta Reticuli
Gamma Hydri
Alpha Pictoris

Data format

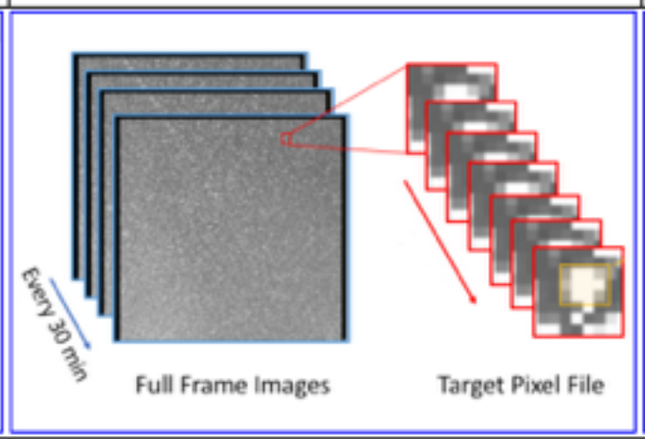
- Cutouts around 15,000 selected stars (per orbit) are co-added over a 2-minute period and saved on board for downlink

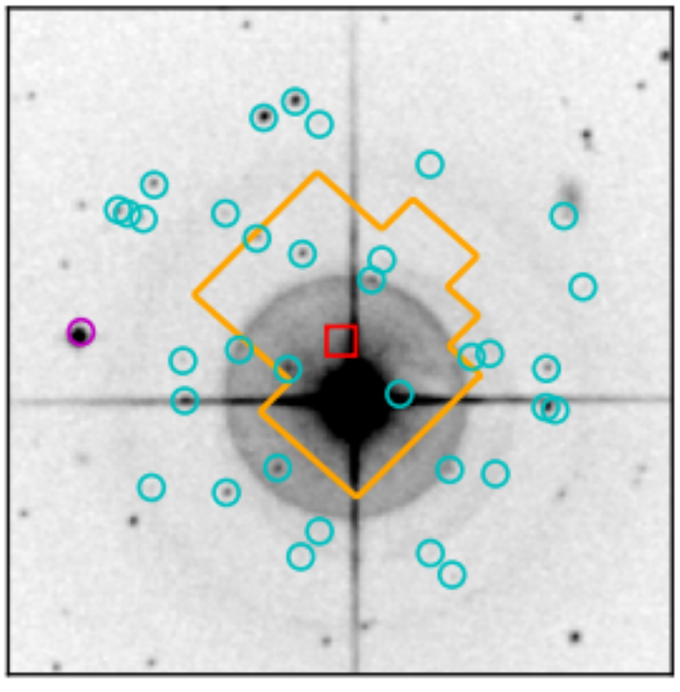
- Full-frame images are co-added over a 30-minute period and saved for downlink.

- The data downlinks will occur every 13.7 days near perigee

Data access

- Data on first 5 sectors is available available at MAST: full frame images, cutouts, pixel light curves…
- Access through Python using the package *lightkurve*

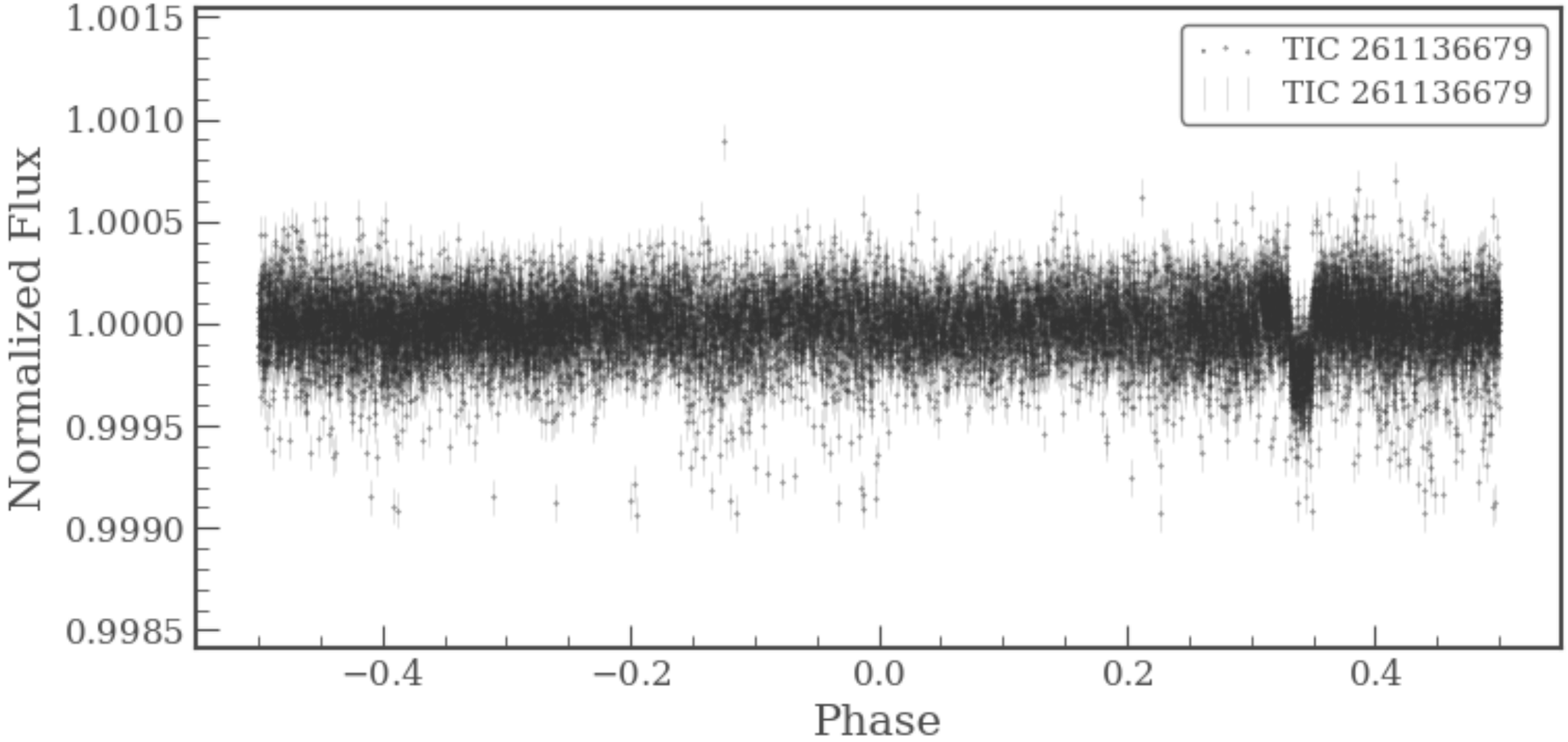
Discovery Portal	Astroquery	TESSCut	Bulk Downloads
			
Cross-mission search across all MAST missions and the Virtual Observatory. Upload source lists, spatial cross-match with MAST, VO, and catalogs. Interactive spectral and light curve plotting, charts, image cutouts, and footprint overlay. Advanced search enables pre-filtering on metadata.	Python package to search for and retrieve data products at MAST. Search for TESS FFIs or two-minute cadence data. Query the TIC or exoCTL catalogs. TESS-specific hints using Astroquery available here.	For users who want to create cutouts from full frame images without having to download the entire field-of-view. Specify central coordinate and size and get back cutouts in target pixel file format.	For users who want to download files in bulk, you may download many types of TESS products in bulk or via URL. This includes the ETE-6 simulated data, TIC and exoCTL catalogs, FFIs, and two-minute cadence data. Visit the Bulk Downloads page for information and access.



TESS aperture 6 × 6 pixels

First TESS exoplanet

Porb = 6.27 days

Mc = 4.52 ± 0.81 M⊕

Rc = 2.06 ± 0.03 R⊕